

Spent Fuel Reprocessing Options

Melding Advanced & Current Technology

Alan Dobson
Senior Vice President
Fuel Cycle & Spent Fuel Management
EnergySolutions

GNR2 Conference
June 13, 2007



GNEP—The *EnergySolutions* Approach

A recycling process (NUEX) that deploys advanced technologies in largely commercially proven equipment to bring significant benefits in

- Waste Management
- Proliferation resistance,
- Safety
- Economics

Maximizing the use & value of commercially proven equipment

Advanced Technology in a facility could comprise of

- Physical & Chemical Processes
- Plant & Equipment
- Control Systems
 - Distributive control
 - Local (PLC) control
 - Special instruments
 - Nuclear Materials & Safeguards

What is NUEX?

- Aqueous based solvent extraction process
- Advanced separations chemistry using relatively new complexants and process reagents.
- NUEX builds upon UREX
- Recovers pure uranium for recycle and a mixed actinide product for transmutation fuel.
- Product stream compatible with either oxide or metal fuel.
- Additional separations can be readily incorporated
- Flow sheet designed to simplify and facilitate waste management.

Simplicity; flexibility; and it works.

Key Waste Management Features

- Long term radiotoxicity of HLW reduced.
- Waste minimization intrinsic to process.
- Process water consumption is reduced through recycling.
- Salt free flow sheet
- Zero, or close to zero, liquid discharge.
- Proven waste treatment process

Integrated Waste Management by Design.

Safeguards, Security & Proliferation Resistance

- State of the art measuring and detection
- No pure plutonium stream, mixed actinide product
- Neptunium daughter very effective tracer
- Designs meet international (IAEA & Euratom) safeguards standards
- Passive, secure cells – utility function value = 1.00
- Process design feature that gives protection of high radiation field – in excess of spent fuel standard.
- Intrinsic proliferation resistance rises when mixed actinides converted to solid form due to increased item accountability.

NUEX is equal to or more proliferation resistant than UREX+1a.

Safety Advantages

- Builds upon years of safe operations
- Lessons learned
- Hazards very well understood, no significant new hazards
- Authorization bases well developed
- Should facilitate the licensing process.

Economics

“DOE seeks innovative thinking by industry that would lead to realization of a near-term commercial endeavor – could include incremental approaches that meet the GNEP vision in step wise fashion”

FOA-GNEP Deployment Studies

Economic Benefits to the EnergySolutions Approach

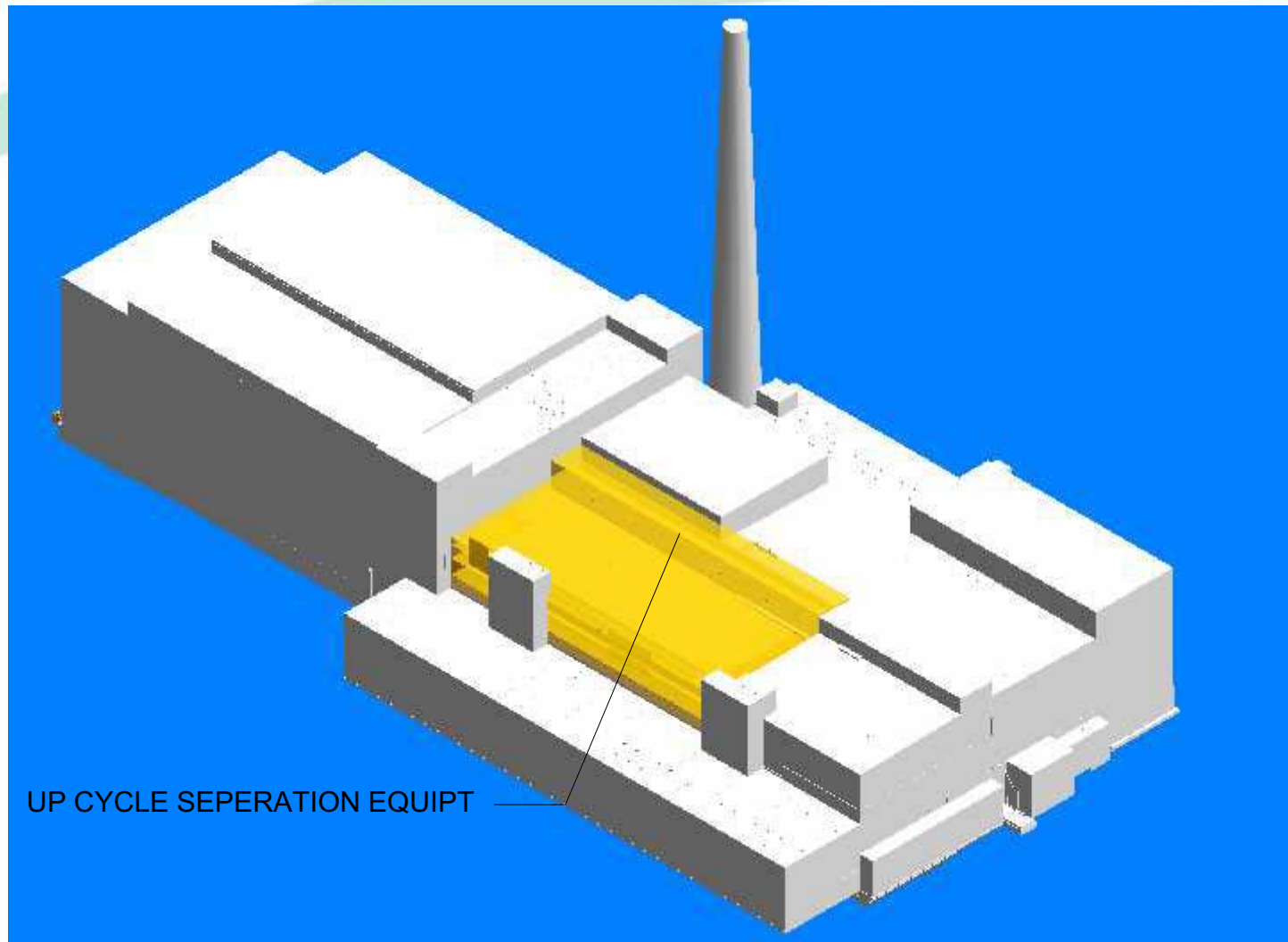
- Expensive, hot, engineering scale, and demonstration avoided
- Testing & Development required, but is minimal and can be managed within design schedule.
- Shortest, least risk, lowest cost schedule.
- Scope to add in additional process models in least costly way.
- Engineering & construction issues minimized.
- Scope to significantly reduce operating costs based upon experience and use of technology.

Fewest unknowns, least risk, lowest cost = Near term realization of GNEP compliant recycling facilities.

EnergySolutions Approach meets the goals of GNEP

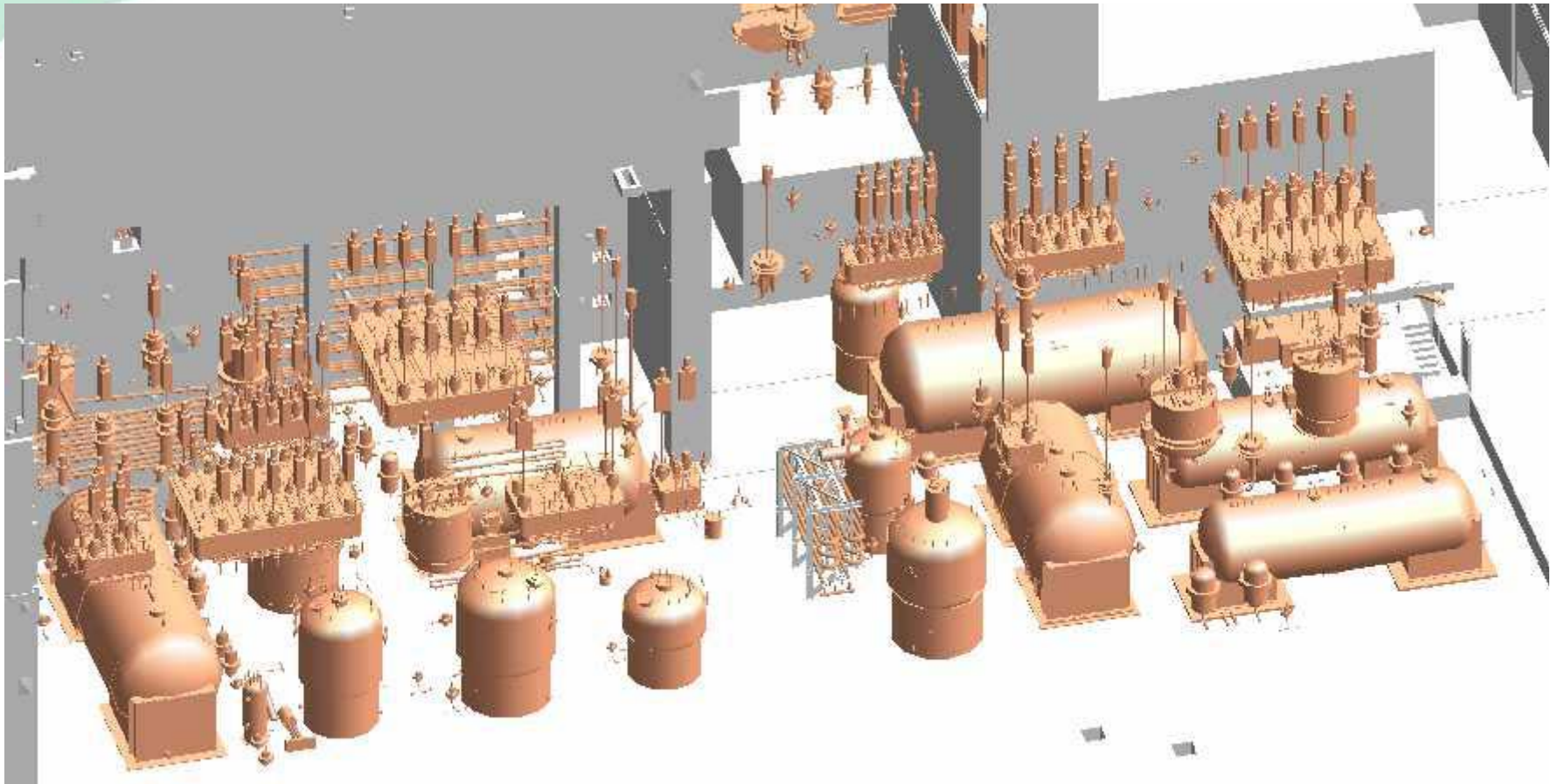
- Enhances energy security, recovers energy from used fuel.
- More efficient disposal of waste materials, lower environmental burden.
 - Significantly improved repository utilization
 - Reduced long term radiotoxicity of waste
- Meets non proliferations goals.
- Maintains/Improves safety and economics.

SEPARATIONS FACILITY



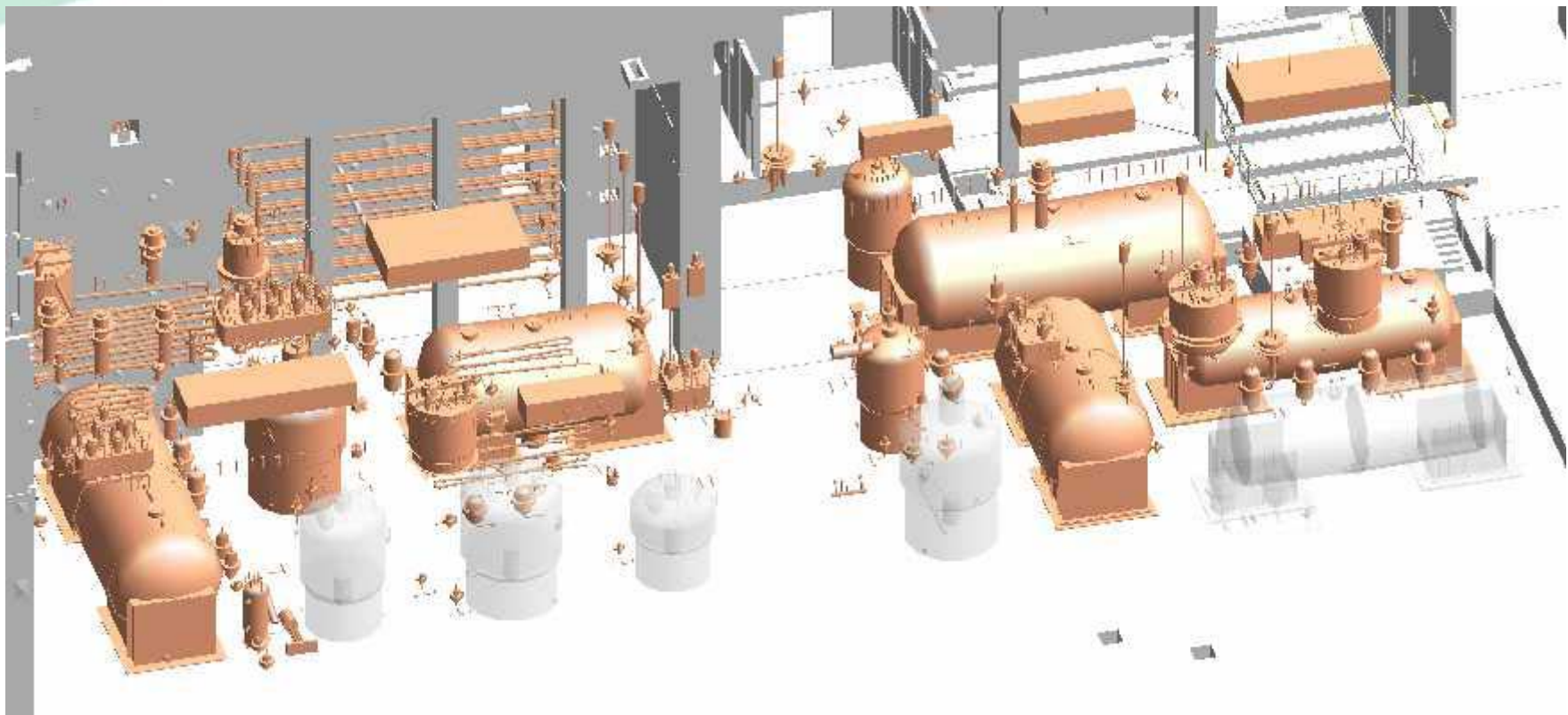
URANIUM PURIFICATION USING MIXER SETTLERS

(NOTE: SEPARATION WALLS AND OTHER DETAILS REMOVED FOR CLARITY)



URANIUM PURIFICATION USING CENTRIFUGAL CONTACTORS

(NOTE: SEPARATION WALLS AND OTHER DETAILS REMOVED FOR CLARITY)



SEPARATIONS FACILITY

